Robotic Helicoil Assembly Proof-of-Concept

Collins Aerospace

Client: Carl Trimble

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VIRGINIA TECH

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Company Background

Collins Aerospace is an industry leader in advanced solutions for the global aerospace and defense industries.

Their **Advanced Manufacturing Engineering & Technology** lab in Rockford, Illinois houses a variety of ABB and Fanuc Industrial and Collaborative Robots for the purpose of testing and developing automation process.

FANUC
CR 7iA/L

FANUC
LR Mate 200iD

Project Background

Current Helicoil Assembly Process:

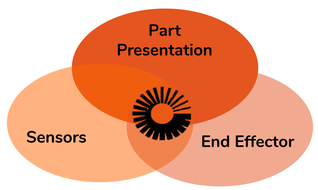
1. 
Operators attain handful of helicoils.

2. Single helicoil inserted into tool.


3. 
Helicoil inserted into 114 holes of Integrated Drive Generator (IDG) Housing Unit.

4. 
If needed, manual rework performed to achieve desired insert height.

Design Components:

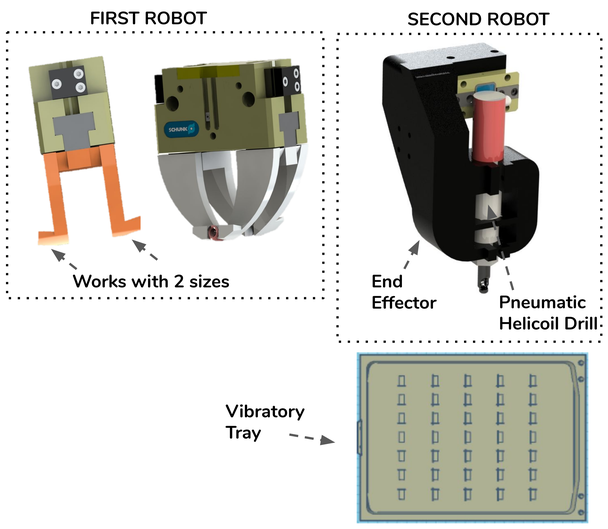


Project Objectives

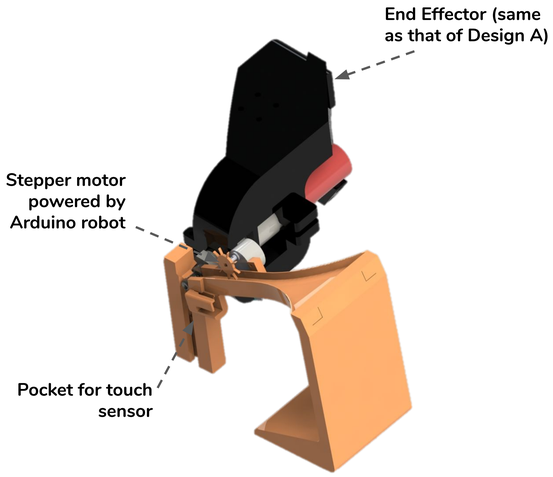
- Develop Successful Proof-of-Concept
  for automating the helicoil assembly process
- Improve Accuracy of Assembly Process
  leading to reduced rework and increased part life
- Reduce Overall Helicoil Assembly Time
  by 30 minutes (20%)

Proposed Solutions

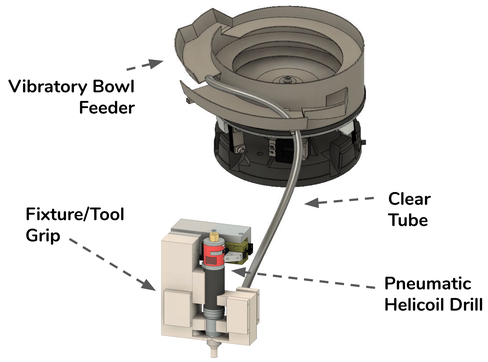
Design A



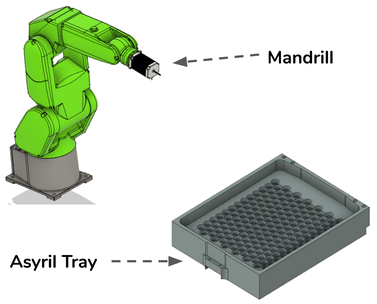
Design B



Design C



Design D



Approach

- Industry Research Benchmark
- Part Presentation Design
- End Effector Assembly
- Sensor Evaluation
- Testing Phase

Results

Comparison of robotic setup designs:

	Weight	Design A	Design B	Design C	Design D
Cost to Build	4	3 ($362)	2 ($759)	1 ($7,248)	4 ($68)
Material Lead Time	2	2 (3 weeks)	4 (2 weeks)	1 (6 months)	3 (2 weeks)
Sustainability	6	4	2	3	1
Presentation Quality	5	4	2	3	1
Ease of Setup	1	3	2	1	4
Human Interaction Rqd	3	3	2	4	1
WEIGHTED TOTAL		**72**	**46**	**52**	**40**

Ranking system used per criteria: 4 (most ideal) – 1 (least ideal)

Most Ideal Design — Least Ideal Design

Selecting Designs to Test

- **Goal**: Downselect to 2 designs.
- **Summary of Table**: Designs A and C have the highest weightings. However, Design C has a very long lead time and is very expensive due to the vibratory bowl feeder.
- **Conclusion:** Designs A and B were chosen to proceed with testing.

Impact from COVID-19

- Due to the COVID-19 pandemic, testing of the designs was not possible at the time. However, resources were given to the Collins team to be able to successfully carry out testing in the future.
- The additional evaluation criteria to add after testing include:
  - Consistency Rate
  - Setup Time
  - Process Time
  - Changeover Time

Impact

- $150,000 Cost Avoided: Professional Consultant Proof-of-Concept
- Time Savings of 30 minutes on Current Process: $67,500 Labor Costs Savings / Year
- Ergonomic Cost Savings of $20,000 / Year
- Ability to Pursue Professional System Integration for Installation of Helicoils